JPRS-UAC-93-006
20 July 1993

JPRS Report

Central Eurasia

AVIATION & COSMONAUTICS

No 12, December 1992

Central Eurasia

AVIATION AND COSMONAUTICS

No 12, December 1992

JPRS-UAC-93-006 20 July 1993

CONTENTS

[The following are translations of selected articles in the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow. Refer to the table of contents for a listing of any articles not translated.]

Air Force Combat Training Problems, Prospects Discussed

93UM0447A Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) pp 2-3

[Interview with Colonel General of Aviation Ye. Zarudnev, deputy commander in chief of the Air Forces, by unidentified AVIATSIYA I KOSMONAVTIKA correspondent: "We Must Not Lose Control Over the Situation"]

[Text] **Russia's Army, Navy, and Air Forces are going through difficult times. The reality of divisions and "outcomes," the shortages of everything, and the uncertainty and lack of social protection dictates the harsh conditions in the functioning of the Armed Forces and raises questions whose solution determine their present and future. One of the key questions is combat training. Colonel General of Aviation Ye. Zarudnev, deputy commander in chief of the Air Forces, discusses its status, problems, and prospects in a conversation with our correspondent.**

[Correspondent] Yevgeniy Pavlovich, how do you assess the condition of combat training in the units, large units, and large strategic formations of the VVS [Air Forces]?

[Zarudnev] About five years ago I would have called it catastrophic. Judge for yourself. With a norm of 150 to 160 hours of accrued flight time per year for a combat aircraft crew, we have been forced to plan for half, but the actual flight time has been 25 to 30 percent of the norm. Our pilots are flying one-fourth to one-fifth as much as they need to. The main reason is the unsatisfactory material and technical support for combat training. The shortage of engineering and technical personnel and specialists in the support subunits, primarily service vehicle drivers, is a no less serious problem. We have 50 to 70 percent of the strength level required. I will not mention the reasons for this situation—they are common knowledge. I consider it necessary to speak about something else. Modern military aviation is a powerful and flexible means of armed conflict. However, we must pay, in the literal sense of the word, and pay a great deal for these attributes. Maintaining aviation in a condition that ensures guaranteed fulfillment of the tasks assigned to it—combat training, in other words—is expensive. We honestly have to admit that we gave little thought to this before. But today the question is a matter of principle. In presenting the requirements clearly, we have been forced to orient ourselves toward potentialities. I mean primarily material and technical support. For this reason, when we refer to combat training, we need to clearly see its immediate objective and future prospects determined by objective circumstances. Inasmuch as they do not permit us to raise the question of full-fledged tactical air training and improvement in proficiency, all available capacities and resources are concentrated today on maintaining flying skills and readiness to perform the combat tasks mastered previously. The course and results of this work, taking into account the country's economic situation and the many other unfavorable factors, may be evaluated as satisfactory with a large margin.

[Correspondent] What is the strength of the units of cockpit personnel now? What has changed compared with last year?

[Zarudnev] The problem continues to be critical. We have to admit that it took us by surprise. Even two years ago, who seriously thought that we would have unneeded pilots? Alas, this is a reality that we must take into account. The future of Russian military aviation depends to a large extent on how we are able to perform the task of training and keeping flight personnel.

The essence of the problem is that you cannot make up for the loss of skilled personnel in a short time even under favorable conditions. Time will be required. An average of up to seven years. It is essential that we clearly understand this and seek to shape a personnel policy efficiently. Yes, it is not simple to do this. Even today we are finding it hard to say how many pilots will remain in the ranks. Because against the background of comparative material well-being of those same civilian pilots who are receiving substantially more today than Air Forces pilots, it is not easy to control the situation. In addition, we have to resolve the dilemma: who should be discharged? The young people, let us assume. But it is no exaggeration to say that this means threatening the Air Forces' future. But if the emphasis is put on trained, experienced pilots and they are discharged first of all, we need not be concerned about combat training any longer. There will not be anyone to maintain it.

Alas, we have to take extreme steps in such a situation. All flight school graduates were given the chance after receiving their diplomas in 1992 to be transferred to the reserve. Half of the graduates availed themselves of this opportunity of their own accord. Of those remaining, 50 medalists were sent by decision of the commander in chief to continue their studies in the Air Forces Engineering Academy. The Russian Ministry of Defense made the decision to increase the period of instruction in Air Forces flight schools to five years. We hope in this way to retain flight personnel and alleviate the problem of excess personnel in line units somewhat. In addition, the five-year program differs substantially from the previous one because of its focus on the graduates' increased professionalism. But for the present, our pilots waiting for apartments often live under conditions which you canot call humane, and when they tire of waiting, they write requests for separation.

[Correspondent] But what relationship does this have to combat training?

[Zarudnev] The most direct relationship. More and more frequently we have to choose whether to order a new complex simulator from industry or lay the foundation for a house. Something similar applies to the purchases of aircraft, which have been cut back to the extent that our orders actually cannot support the distressed

industry. In both cases, the choice is being made more and more often to build the housing.

About funds, by the way. The difficulties that the Air Forces are experiencing from their shortage do not mean that there are no funds at all. That is not the case. We simply need to free ourselves of the popular stereotype that any measures that require additional financing may be implemented exclusively by a centralized increase in the appropriate budget items. Take the same problem of training flight personnel in the Air Forces' VUZ's [higher educational institutions]. Everything begins with the profotbor [selection process], whose objective comes down to a simple thought: not everyone is given the right to fly. The methods developed make it possible to single out four groups of professional fitness. In giving unconditional preference to the first group, we accept matriculants from the second and third groups in the schools. In order to select primarily from the first group, we need to bring the competition up to 10 to 12 persons for each position. But in order to create such a situation, we need to establish attractive economic and living conditions. Will this require additional expenses? Correct. However, in my view, it is legitimate to compare these expenditures with investments in a long-range but very profitable project whose implemnentation will ultimately pay back all the expenses with interest—in this case, by reducing the losses of expensive aircraft as the result of accidents.

Another example. We ask for a minimum amount of fuel for combat training. There is no money, we are told. Aircraft remain on the ground and pilots lose their skills. Sooner or later they will have to be restored. But after all, this will cost much more than retaining skills. And it is this way with a number of problems. But tell me, who is fully taking into account the costs for redeployment of troops, the establishment of new forces of combat aircraft, and a great deal more today? So it turns out that the military budget is limited and specific expenses are increasing. Just what is left for combat training? Alas, they know about this in the units. Under such conditions, it is important to organize the work so that commanders do not ascribe their neglect to current difficulties and inspecting officers do not require what is impossible in principle: I do not know how, but it must be carried out....

A few words about engineering and technical personnel. Alas, I repeat, we do not have enough people. What can you do—service as an officer in the Air Forces has become unattractive, especially in engineering and technical positions. How do we raise the prestige of these specialties and interest people? It is obvious that a specific, well-considered program will be required here. But for the present, special steps are being taken. A proposal to increase the job categories for certain engineering and technical positions is under consideration.

[Correspondent] Today, when Russia is going through the hardships of the stage of extensive reform in the economic, political, and social spheres, the question is rightfully asked: what can we do? How would you respond to this as applied to the tasks and problems of combat training in the Air Forces?

[Zarudnev] In general, I will answer this way: by understanding the problems and taking them into account, we need to improve organizational work at all levels of management to avoid losses and counter the difficult pressure of circumstances. We need a thorough and objective analysis of the state of affairs, based on the development and implementation of measures to prevent a decline in the level of combat training that has been achieved. As an example, insufficient flying time must be compensated, insofar as this is possible, by carefully organized and intensive training on the ground and by making maximum use of all its forms and methods. At the same time, we have to take the level reached up to 1992 as the reporting point, the position, which we must try to retain under any circumstances.

Under the conditions of insufficient flying time, a strict individual assessment of his actual readiness is especially important for the pilot. With the active assistance of scientific institutions, criteria are already being developed for overall evaluation of a pilot's knowledge, skills, and moral and psychological readiness to carry out a flying mission. How important this is, especially under current conditions, may be judged by this example. In the combat training courses for different air components, there are up to 60 elements for which maximum break periods have been established. However, the lengths of the breaks are calculated for an abstract "average" pilot. As applied to a specific person (let us recall the four groups in the selection process), they may vary as an increase or a decrease. But how do we make use of this circumstance in practice without a risk? For example, how realistic is it to evaluate the level of actual proficiency?

Such methods are already partially available. They make it possible, by utilizing data from objective verification materials and with the help of a highly reliable computer, to determine deviations in proficiency and to draw a conclusion about the pilot's actual readiness to carry out a flight mission.

The handbook "Minimum Knowledge for Cockpit Personnel...and Safety Measures by Stages of Flight," based on requirements of the operating manual for a specific type of aircraft and other regulations, has been developed to evaluate theoretical training. We are not forcing the pilot to know them by heart now. However, he is obliged to master the "minimum" completely.

The most complicated problem thus far has probably been assessment of moral and psychological readiness for a specific flight. Every pilot has had occasion in certain situations to go through far from inspiring experiences in thinking about a forthcoming flight, to have doubts, and to ask himself the question: can I handle it? A method has already been worked out and a special device has been developed that makes it possible to

check the moral and psychological condition of the pilot at intervals before a flight by his heart contractions. The method is particularly attractive because in principle, the pilot can assess his condition independently, without participation by a physician and the commander. At the same time, the very delicate nature of such an evaluation and the problem as a whole is taken into account. Of course, aviation units will have to be provided with the appropriate computer hardware to introduce these methods. This work has already begun.

In the meantime, before these methods are implemented in line units, the large strategic formations have to be guided by recommendations from the Air Forces' combat training staff.

So in planning and organizing combat training, it is especially important not to lose control of the situation, to take its special characteristics into account to the maximum possible extent, and to make use of available funds sensibly. Individual evaluation of each pilot with the aid of current methods is especially important. The purpose of the work is to keep the pilot and keep the aircraft, because in the final analysis, this is the present and future of Russia's Air Forces. And Russia's Air Forces have a future!

[Correspondent] In conclusion, tell us about yourself, Yevgeniy Pavlovich.

[Zarudnev] I was born before the war in 1940, in Stalingrad, in the family of a white-collar employee. I still distinctly recall the effects of that terrible war. The city was in ruins. We children walk several kilometers to school along paths with small white flags with the inscription "mined." And we play, competing to see who has more fragments, scooping up the soil wounded by steel from a huge mound.

We lived near the Kachinsk School, and I have been interested in aviation since childhood for that reason. After completing secondary school, I went to work at a plant in 1957 and attended the evening division of the Polytechnical Institute. When the time came to serve in the Army, the military commissariat suggested that I enter flight school. I agreed and went to Eysk. In 1963, I graduated with honors from the school and was made an instructor despite my wishes. Then the academy, where I completed studies with a gold medal. My first assignment was in a combat regiment—as deputy commander of an Su-7 squadron. Later I served in various places in all positions up to commander of a large strategic formation, and I went through the General Staff Academy. In September 1991, I was named deputy commander in chief of the Air Forces for combat training. I began flying in the Mig-15, and mastered all versions of the Su-7, and recently I flew an Su-24. I am married and have two daughters. Circumstances have been such that I have had to abandon flying work, although my health is fine, as they say. I dream about being authorized by the commander in chief of the Air Forces to make familiarization flights in advanced aircraft which I have not had the occasion to fly.

Combat Pilots Helped by 'Artificial Intelligence'

93UM0447B Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) pp 4-5

[Article by Colonel (Reserve) V. Babich, candidate of military sciences: "Artificial Intelligence at the Service of the Pilot"; continuation of series begun in issues No. 10 and 11 of the journal]

[Text]

3. 'The Electronic Pilot' Prepares for Combat

Within the framework of a program "To help the pilot," specialists from various firms in other countries are developing a number of expert systems intended to provide the crew of an aircraft with intellectual support in making decisions in the principal stages of combat flight.

At first glance, it is hard to expect a thinking process related to human thinking, even from the highly sophisticated electronic equipment being used as an "expert." Nevertheless, these systems, called "electronic pilots," are already being developed. Depending on the level of knowledge incorporated in their memory, they are divided into three categories: **"consultant," "assistant," and "fellow pilot."**

The "consultant" frees the pilot when he is making a decision to engage the enemy (mount an attack) from the "tedious" work of a computing nature, thereby creating better conditions for a detailed assessment of the situation and planning further actions. However, it does not take any part in directly preparing and making a decision, since this is the pilot's prerogative.

The "assistant" is able to make suggestions to the pilot in resolving a complicated situation and even substantiating them to a certain extent. However, this applies only to those suggestions that are primarily informational and not related to the shaping of combat logic. Close interaction with the pilot is required to a greater extent for the "assistant" than for the "consultant," and this frees the pilot from routine work, helping to reveal his creative potential.

The "fellow pilot" is closest to the pilot in its level of "thinking." It functions in the stage of preparing decisions of an organizational and tactical nature and makes the recommendations necessary to implement them, as if embodying the form of an "artificial intellect."

It is not hard to notice that the decisions made by the pilot also can be divided into three groups: informational, organizational, and tactical. To a significant extent, this division facilitates systematic analysis of the process of the pilot's mental work in a combat flight. Indeed, in the first stage, a flight commander reveals the enemy's intention in assessing the flow of information; in the second stage, he organizes preparation for combat by arranging subordinate crews in flight in the order needed and assigning them specific functions; and finally, in the third stage, depending on the situation that has taken shape, he makes use of one of the standard tactical devices.

Why namely the standard ones? After all, it has always been thought that each decision by a commander should be the result of a creative search for nonstandard actions in any situation, no matter how complex it is. However, we cannot help but take another opinion into account: that the tendency to approach the implementation of any conscious action creatively inevitably leads to underestimation of the experience that has been accumulated and the loss of acquired skills. Its correctness is confirmed in practice to a certain extent: new tactical devices are not created every day, and the list of them, let us say frankly, is not endless (only about 30 have been formalized by American scientists, for example). As a rule, changes in tactics take place only when a new generation of aircraft makes its appearance. If the process of its development is held up, repetitions in tactics become unavoidable....

However, let us turn to the U.S. manual on combat employment of tactical aviation, which states: "Complete standardization in the process of combat actions may lead to serious problems: when an enemy encounters predictable tactical routines by our side he will discover our intention. However, in the majority of cases, the procedure for actions should be subject to strict rules, that is, standardized within sensible limits. Standardization in this sense means only increasing the flexibility of a maneuver. The result is a rapid, controlled reaction and a tested version of actions in predictable circumstances."

In my view, it is appropriate to recall here that during its tests in the war in the Persian Gulf, the "electronic consultant"—the IMOM system—offered the pilot one of three standardized tactical devices to avoid PVO [antiaircraft defense] fire, to neutralize PVO facilities, and so forth. It did not recommend anything new to the pilot, but selected from its memory a variation of actions already very familiar to him, which were considered most appropriate in the situation that developed.

A more improved expert system, which has been tested in full-scale modeling of combat flight by the advanced ATF fighter, operates in accordance with a similar principle. A twin-engine transport aircraft specially filled with electronics and "equipped" with a standardized version of the ammunition planned to be used by the new-generation fighter served as its prototype for conducting the tests. Simulators on the ground "played" as the DRLO-VKP and REB [AWACS and electronic warfare] aircraft, with the help of which a situation was "created" that was close to actual combat. Because a full-scale experiment was conducted under what appeared at first glance to be oversimplified "laboratory" conditions, substantial savings were achieved and it became possible to repeat it over and over in case of questionable results.

The tactical situation was changed during the experiment by shifting the "enemy" forces from one initial status to another to the extent that "the ATF fighter" came closer to the assigned intercept point (130 to 150 km behind the front line established). In this flight stage, the expert system, which was operating as an "assistant," gave the crew informational decisions and "prepared the ground" for making an organizational and a tactical decision.

According to the researchers' plan, assessment of the situation was to conclude by determining the "enemy's" status and subsequently revealing his intention. This process, experience has shown, came down to a search for answers to the questions: where? how many? who? Information on the location of the flight of "enemy" aircraft and their number was the input data for the expert system; the data's reliability depended on the effective range and resolution of the "fighter's" BRLS [airborne radar]. The "electronic pilot" systematized the incoming information in accordance with the resemblance of the targets detected to those incorporated in its "memory," which has numerous other similar features. Multiple values were not permitted in their comparison. Otherwise, the specialists believe, the "food" for making a tactical decision would become scanty and would not enable the "assistant" to come out of a state of uncertainty because of the reduced flow of information on the "enemy."

However, the latter was in no hurry to reveal its intention ahead of time and took effective countermeasures: he changed the arrangement of his combat formation, began radioelectronic jamming, and maneuvered at altitude.... The tests showed that it was especially difficult for the "electronic assistant" to detect a sign of "uniformity" in the makeup and tactical assignment of a multiple target, since all its elements had an identical radar signature in a number of cases.

Experience in the war in the Persian Gulf showed that identification of the target was made when the enemy's distance from the intercept point was too short. For this reason, it was decided in the course of the tests to approve one of two alternative actions: either to move the intercept point closer to the "front line" or to bring the "fighter" out of the zone of "uncertainty" in the situation. Inasmuch as the feasibility of the first alternative was ruled out for completely understandable reasons, preference was given to the second one, which provided for close interaction between the crews of the

"fighter" and the AWACS aircraft. In this case, the "electronic assistant" was to establish the nature of the target only in accordance with its "external signature."

Specialists have emphasized in this connection what in their view is a very important detail that concerns the interrelationship between man and machine. During the period of training for the flight, the pilot had the opportunity to fill the memory of the on-board electronic system with the features of an unlimited number of enemy aircraft. Nevertheless, this did not relieve the crew commander of the need to be objectively familiar with the enemy's tactics, especially their strong and weak points, to be able to continuously accumulate data on the reaction of the opposite side to typical threats, to interact competently with the "assistant," and so forth. In other words, to the extent that the pilot fills the "smart" system with initial data and demonstrates his tactical wisdom in "conversation" with it, that is the extent to which the help of the "expert" will be effective in flight. After all, the principal value of the system is its ability to "think" rapidly when a person is not in a position to "digest" the flow of information coming to him. By extracting a version of a solution from its memory, it offers the flight commander the most acceptable ways to get out of "difficult" situations.

It is noteworthy that the procedure for functioning of the expert system is similar in many respects to the process by which the pilot makes a decision in a routine situation. Indeed, it "screens" the flow of incoming information like a filter and picks out only what is necessary for subsequent analysis of the enemy's status; it evaluates the situation (identifies a specific situation); it works out the most suitable alternative for disposition of forces before an engagement (a strike); and finally, it selects the best method of combat (the most effective tactical device).

In the American specialists' opinion, when data on an enemy is coming in continuously from different sources of information, such an algorithm facilitates practically instantaneous reaction by the "electronic pilot" to the slightest change in the situation in the air, which has a positive effect on the results of a combat mission.

(To be continued)

Use of Highways as Runways Recommended To Improve Readiness

93UM0447C Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) pp 6-7

[Article by Colonel N. Tsupko, candidate of military sciences: "An Aircraft on the Highway"]

[Text] **This is not a paradox, but a deliberate requirement for dispersing and maneuvering aircraft in the initial period of a war.**

More than 800 aircraft of the Red Army's VVS [Air Forces] were destroyed at airfields on 22 June 1941.

Why did we suffer such heavy and humiliating losses?

The entire force of combat aircraft in the Air Forces of the western military districts (VO) near the border were concentrated at 66 airfields. There were 100 to 150 or more aircraft based at an airfield. However, the VVS combat force of the Leningrad and Odessa military districts and the Baltic, Western, and Kiev special military districts (OVO) was made up of 7,133 aircraft and a network of 614 airfields. Simple arithmetic shows that there could be no more than 11 or 12 aircraft on each one of them.

So why was such an available network of airfields not utilized? There are two reasons for this. First, the VVS of the military districts near the border had begun retraining with new and technically more advanced types of aircraft, and not all the airfields had the size and equipment to meet takeoff and landing safety requirements. Second, modernization of existing airfields and construction of new ones were begun at the end of March 1941. Work was under way simultaneously at many operating airfields, but it was proceeding very slowly. So the planned volume of work had been performed at only 13 airfields and only 25 to 50 percent of the work had been completed at 144 airfields as of 1 June 1941.

The depth of basing was inadequate. Fighter and ground attack aircraft units, which made up over 60 percent of the VVS combat force in the western military districts, were based 60 to 110 km from the state border. Some airfields for army aircraft were located at the range of an artillery round—12 to 20 km. When the war began they were seized by the enemy.

And one more feature. Over 50 percent of all the airfields in the Red Army VVS (614 out of 1,147) were located in the western military districts. Construction of new airfields in the European Theater of Military Operations (TVD) in the postwar period left this tendency to concentrate their main efforts on the western borders practically unchanged. It is not hard to calculate how few airfields were left on Russian territory (especially in its European section) after formation of the CIS.

Perhaps we will not require military airfields at all?

In answering this question, I would like to refer to what Marshal of Aviation Ye. Shaposhnikov said when interviewed by the editor of the journal VOYENNAYA MYSL (No. 6, 1991, page 9) on the role of the VVS in the Joint Armed Forces: "Even with the presence of a defensive military doctrine we cannot lose parity in the means of defense maneuvering; otherwise we concede the initiative in unleashing war to the enemy. With a reduction in the number of aircraft, their mobility, viability, and striking effectiveness should be increased to an equivalent degree."

In analyzing these parameters, it is not difficult to come to the conclusion that they all depend (together with other factors) on the conditions of aircraft basing: mobility and viability from wide dispersal and maneuvering of aviation units, and striking effectiveness from the best possible basing depth, which makes it possible for aircraft to use the largest possible combat payload. Consequently, in order to increase efficiency in the use of aircraft we must improve their basing conditions.

How do we achieve this? The answer is clear—by building new airfields and modernizing the existing airfields (especially the unpaved ones) ahead of time. But will the VVS be able to perform this task independently when the military budget is being cut back continuously? Probably not. And this is why.

First of all, because of the shortage and high cost of building materials and the work being performed, and secondly, because insufficient roadbuilding equipment is available to airfield engineer units because of its increased cost (AVIATSIYA I KOSMONAVTIKA No. 9, 1991). While in the period "before perestroyka" an airfield engineer battalion spent no less than two construction seasons (summers) to build a Class-2 airfield with a concrete runway, these periods will increase now, obviously. Third, because of limited opportunities to find areas suitable for airfield construction. We can find one such parcel in an area of 1,000 square kilometers of average topography, but it will be more and more complicated to obtain it because of the transfer of land to private ownership. It is just as hard to assume that the Russian Government may concern itself with a decision on this matter during the period of transition to a market economy.

So what is the solution? How do we resolve the problem of improving the conditions for basing aircraft? Let us look at foreign experience.

In a number of developed countries with limited territory (Germany, Sweden, Finland, and others), they plan to use not only all available airfields suitable for military use during wartime, but sections of main highways (UAD) as runways for temporary airfields. This provides the air forces with considerable opportunities to maneuver secretly and it facilitates camouflage substantially, since the runway—the most characteristic identifying feature—is an integral part of the highway and blends well with it. The aircraft are dispersed by zones and camouflaged utilizing modern means.

Foreign military specialists believe if the danger of damage to aircraft parked openly and not dispersed at airfields is taken as 100 percent, it is reduced to 30 percent when they are dispersed (without shelters) and reduced to 5 percent when shelters are available. When camouflaging is organized and airfields have the direct protection of antiaircraft weapons, aircraft vulnerability to damage may be reduced to 2 percent. In this way, the measures stipulated may ensure a sufficiently high survival rate for aircraft in the initial period of a war.

The soundness of this is hard to dispute, though such measures can be implemented only in countries with a developed network of airfields and highways. But in Russia's territory, the use of sections of main highways as runways has not been widespread.

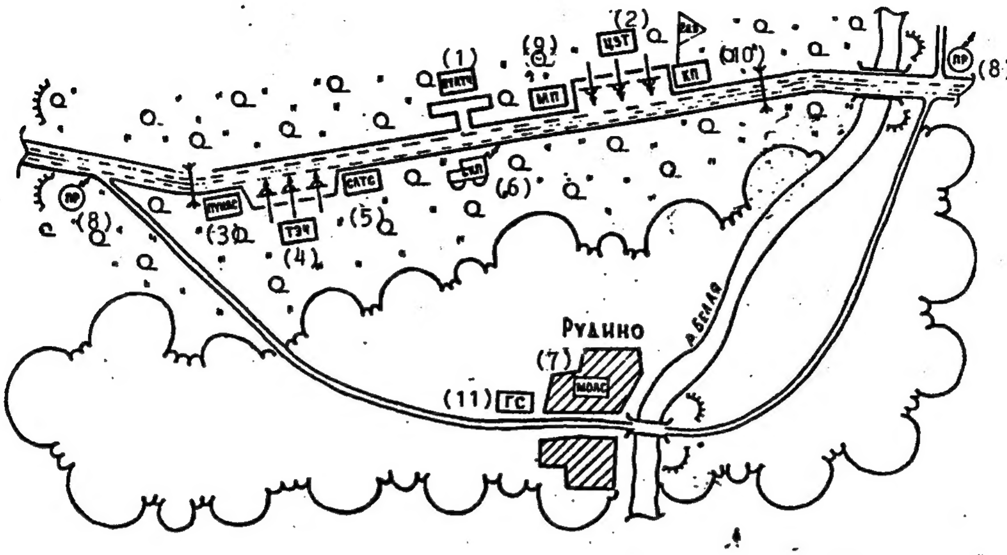
It is obviously advisable to begin restoring the economy and reinforcing the defensive capability of the Russian state with the construction, renovation, and repair of highways for efficient and economical operation of the form of transportation in widest use—motor vehicles. And when the roads are built and renovated, we have to start with the combined use of highway lines of communication. For example, this means a section prepared in advance with a rest zone for drivers and passengers on a highway for general use (ADOP) may be used without additional economic expenditures as a road traffic control area (DKR) for organizing a road traffic control service (DKS) on a military highway (VAD) or airfield (takeoff and landing area) for the temporary basing of military aircraft.

It is apparent from the drawing that the facilities provided for the convenience of passenger and freight traffic on a highway for general use are identical to the DKS servicing points on a military highway and may be adapted to control aircraft landings and takeoffs, direct combat operations, and provide aviation engineer and rear services support for the temporary basing of aviation subunits.

Such facilities are called airfield road sections (AUD). They should meet the following basic requirements: have a straight paved surface 2,000 to 3,000 meters in length and a road bed 16 to 20 meters wide without a dividing barrier, runway threshold overrun strips, and air approaches appropriate for Class 1 and 2 airfields. Surface communications lines, power transmission lines, drainage structures, and a bypass of the AUD should be located outside of the threshold overrun strips. The AUD should provide the opportunity for rapid deployment of radio and airfield lighting equipment, centralized aircraft refueling, and the placement of rubber-fabric tanks to store GSM [fuel and lubricants]. It is expedient to ensure that there are considerably more such AUD's than the number of airfields for permanent basing during peacetime.

Construction of AUD's provides the Air Forces not only with the operational and tactical conditions for protecting aircraft during the initial period of a war, but the economic advantages of theater of military operations facilities during peacetime. Substantial sums of money will not be required for the plots of land to build airfields, only proportional participation in building the runway and facilities for material and technical support and everyday services.

For this purpose, the Russian Ministry of Defense will apparently be required to apply to the Russian State



Автомобильная дорога общего пользования, оборудованная под ВПП

ПУАТЧ — пункт управления авиационно-технической части
ЦЗТ — централизованная заправка топливом
ПУИАС — пункт управления инженерно-авиационной службы
ТЭЧ — технико-эксплуатационная часть
СЛТС — столовая летно-технического состава
СКП — стартовый командный пункт
МОЛС — место отдыха летного состава

General Use Highway Equipped for Use as Runway

Key:
1. Aviation technical unit control point (PUATCh)
2. Centralized fueling (TsZT)
3. Aviation engineer service control point (PUIAS)
4. Technical maintenance unit (TECh)
5. Aircrew and ground personnel mess (SLTS)
6. Control tower (SKP)
7. Aircrew rest area (MOLS)
8. Traffic control post (PR)
9. Medical point (MP)
10. Command post (KP)
11. Support group (GS)

Concern for the Planning, Construction, Renovation, Repair, and Maintenance of Highways (Rosavtodor). It is expedient for a VVS command to develop the planning documents in accordance with standardized requirements and for construction of the AUD to be undertaken jointly by the Rosavtodor, the VVS, and the road service of the VS [Armed Forces] rear services.

Putting the recommendations made into practice will make it possible to increase the viability of aircraft at the beginning of combat actions by maneuvering aviation units to the AUD's and avoid the tragic effects of the first day of war.

Safety Problems in Instrument Landing Explored

93UM0447D Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) pp 8-9

[Article by Lieutenant Colonel of Medical Service V. Kozlov, candidate of medical sciences; and Colonel (Reserve) V. Dudin, candidate of military sciences: "The Psychological Phenomenon of the Search for Land"]

[Text] **The primary airfield did not take the transport aircraft because of weather conditions, and they directed it to an alternate airfield. Although the weather in that area turned out to be no better, it received the "OK" to descend from its flight level and initiated the long-awaited maneuver for its landing approach after a long flight. The**

aircraft was approaching land through thick clouds on a winter night. "We have turn to the right, commander," the navigator reported. "I see a light," the commander said some time later, after making a corrective turn in the direction indicated by the navigator. Several seconds later, the aircraft hit a structure 1,840 meters from the runway and 260 meters to the right of the runway center line. The "light" on the structure's roof was assumed first by the commander, and then other crew members, to be a runway light...

Investigation of this aircraft accident was conducted efficiently because of the performance monitoring and recording devices on board (including radio traffic). In this case, practically all the danger factors that became apparent during development of the emergency could be established and the principal reasons for what had happened could be determined—violations by the aircraft commander in organizing the aircraft's flight and its clearance to land at an airfield below weather minimums; shortcomings in air traffic control; inadequate utilization of the airfield's radio and lighting equipment; the landing radar (PRL) was not in operation and the automatic radio direction finder (ARP) and flashing light were not in use; and the crew failed to adhere to standard procedure in a landing approach at night under SMU [instrument weather (IFR) conditions].

The causes revealed in the investigation process make it possible to substantiate recommendations for the prevention of such LP [aircraft accidents] in the future by basically improving methods of air traffic control and organizing crew training, not only at the regimental level, but at higher levels, where flight procedure documents are prepared. But this often proves to be insufficient to ensure high reliability in pilots' actions in emergency situations. This is explained by the fact that it is essential to know not only the **strictly professional** nature of the errors committed by other crews in a particular situation, but their **psychological** nature as well, in order to ensure efficient activity by cockpit personnel. Only by examining the mental mechanism, which regulates a pilot's activity in flying an aircraft and the psychophysiological characteristics of his conduct, does it seem possible to develop the most effective preventive measures for cockpit personnel. This is precisely the objective pursued by psychological analysis of the circumstances of an aircraft accident. But what has it enabled us to determine in this case?

First of all, three stages are defined in activity by the commander, as well as other members of the crew as a whole: the preparation stage, the landing approach, and the onset of an emergency situation. Each stage has its own characteristics.

After receiving clearance for the approach (the preparation phase), none of the crew members, primarily the aircraft commander and the navigator, performed all the necessary actions aimed at ensuring a guaranteed safe landing under IFR conditions at night at an unfamiliar airfield. Despite the information received from the flight operations officer on deteriorating weather conditions, the pilot did not specify the decision height for the final approach descent and did not put the dangerous altitude selector at an appropriate setting for sound signaling to function. In addition, the crew members did not size up the situation, mainly the shortcomings in the operation of landing aids at the airfield (landing radar, automatic radio direction finder, flashing lights) to determine the best method of using them and organizing efficient interaction between them. They did not call for information on the features of the airfield itself (the nature of the terrain in the approach area, the presence of obstructions, and the like). The flight operations officer was also negligent in this situation.

As a consequence of all this, steps were not taken in the preparatory stage to provide for the two most important conditions in making a safe IFR landing at an unfamiliar airfield: avoiding descent on the glidepath below a safe altitude and combined use of instruments to determine heading in the approach, especally after passing the DPRM [outer compass locator].

The errors in crew members' activity in the preparatory stage led to serious consequences. It is appropriate to note here that in using the concept of "pilot error," we are not blaming him for it, since many of the erroneous actions committed by the crew were caused by shortcomings in training flight personnel and in the organization, control, and conduct of the flight, that is, these are errors attributable to the human factor, not a "personal" factor.

So the altitude maintained in the final approach was below that established for the glidepath by 90 to 110 meters. Moreover, the crew did not monitor the approach to the decision height and did not reserve the opportunity to make a missed approach go-around. All their efforts were concentrated on establishing visual contact with the ground as soon as possible. This was the usual recurrence of one of the most important psychological phenomena observed repeatedly in an approach under IFR conditions—**the dominant condition of the search for land.**

Research by scientists at aviation medicine NII [scientific research institutes] has shown that in making an instrument landing approach, such a psychological condition often develops and predominates even in an experienced pilot, and he actually begins "looking" for land from a certain altitude without realizing it. And the less experience he has, the higher the altitude. In this case, the search itself is an independent task whose solution distracts the pilot from observing the readings of flight control and navigation instruments and often leads to loss of spatial orientation until he comes under the clouds. He can avoid development of this condition by consciously regulating his activity duriung the approach and by making use of the positive aspects of interaction with other crew members.

In the accident investigated, not only the commander, but other crew members, experienced this psychological

condition. Neglecting their monitoring of the altitude, they "looked for" the land and reference points on it. In addition, judging by the radio traffic, the direction of flight on the glidepath was maintained only in accordance with the ARK [aircraft radiocompass], which had been set to the outer compass locator. At the same time, the accuracy of its readings was not verified by using the data from other navigation instruments. And the information which the navigator provided to the pilot that the runway was to the right (according to the radiocompass) proved to be inaccurate. As a result, after the aircraft made the correcting turn, and at a lower altitude, it deviated from the center of the glidepath.

We believe that the third—emergency—stage of the flight began at that point. As psychological analysis has shown, one more dangerous factor making its appearance here deserves special mention—the presence of a structure on a hill near the runway with a light source similiar to runway lights. It was precisely what the commander, and then other crew members, thought to be a runway light, which at that moment confirmed what they imagined to be the "correctness" of their approach direction after the correction to the right.

Psychological analysis of the accident enables us to single out the main reasons for it at the level of the mental mechanisms regulating his activity and its psychophysiological characteristics, and provides the opportunity to visualize each mistake by a crew member more clearly. On this basis, specific preventive measures may be defined for cockpit personnel to eliminate the repetition of such situations and especially the development of similar ones.

Special studies may be recommended to examine the most typical errors, setting forth the psychophysiological characteristics of their onset and providing special practice drills with simulation of particular situations to work out the best possible algorithms of actions by crew members to counter them, and study of the causes of the worst aircraft accidents from the results of their investigation under the guidance of experienced pilots specialized in training methods and officers of the SBP [presumably: Flight Safety Service].

Need To Economize Fuel, Lubricants Stressed

93UM0447E Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) pp 9-10

[Article by Colonel Yu. Kuzmin, candidate of technical sciences, and Colonel V. Golubushkin, candidate of technical sciences: "Worth Its Weight in Gold"]

[Text] **Provision of VVS [Air Forces] units with fuel, oils, lubricants, and special fluids (GSM) has become worse under the conditions of the shift to the market and intensification of the economic crisis. This is caused by reduction of the volume of petroleum extracted and refined, the disruption of economic ties, and other factors.**

Installations to produce additives and components, without which the development of aviation GSM [fuels and lubricants] and complex multicomponent substances is impossible, are being dismantled at certain plants for economic and ecological reasons, and the delivery of certain GSM specifications for the military has been practically discontinued as a result. The cost of aviation kerosene has increased by nearly 200 times as much since 1990, a metric ton of AMG-10 oil began costing about 40,000 rubles by mid-1992, and these prices continue rising. GSM's are truly worth their weight in gold...

For this reason, every specialist taking part in the organization of flight and maintenance operations and aircraft (AT) repair should become thoroughly aware of the vital importance of economizing GSM's, for each kilogram of them saved in the flight of one aircraft turns into tens of thousands of metric tons a year for the entire fleet of aircraft!

Practice shows that fuel economy in flight operations is also related to flight safety. For example, results obtained from cockpit recorder tapes processed from 520 flights of one type of aircraft by Lieutenant Colonel A. Polozov and Major A. Lebedev have made it possible to determine the errors committed by cockpit personnel: on 50 percent of these flights, errors on takeoff (excessive angle of attack, and so forth), 7 percent in climbing, 6 percent in cruising flight, 13 percent in landing, and in 2 percent of the cases, in operating the power plants.

One of the air subunits directed attention to the fact that crews conducting flights with identical takeoff mass are using the engines' takeoff regime differently: the altitudes at which they were shut down ranged from 200 to 1,800 meters and the time ranged from 20 to 170 seconds. But after all, the takeoff regime is also the regime of maximum fuel consumption!

Experience in aircraft operation in civil aviation, where the problems of economizing fuel and power resources have always been given considerable attention, attests to the fact that in a two-hour flight by a Tu-154 with a takeoff mass of 85 to 90 metric tons, for example, 5.5 percent of each metric ton of fuel filled in excess of flight planning calculations (IShR) is consumed practically to no purpose in the delivery of this excess metric ton. That is, if 5 metric tons of "extra" fuel is taken on board, 275 kg of it will be consumed uselessly. At the same time, the greater the aircraft's takeoff mass, the greater this consumption will be. Increasing the takeoff mass at the cost of "extra" fuel increases the load on the structure of the aircraft and leads to engine operation at higher regimes than usual. Consequently, fueling in conformity with flight planning calculations, together with fuel economy, is a condition for maintaining airframe, landing gear, and engine reliability.

Solution of the problem of GSM economy is impossible without scientific research in this field, including establishment of an efficient period of time for replacing lubricants and switching to use in accordance with their actual quality. Based on studies conducted in recent years, the replacement of oils and lubricants at a number of aircraft facilities has been increased by 1.5 to four times as much. Hydraulic fluids in aircraft systems and aviation repair enterprise (ARP) test stands have been replaced not in accordance with calendar periods, but only when the permissible values are exceeded by the quality indicators stipulated for these fluids. However, experience in operating aircraft shows that these values are not limiting and they may be adjusted.

It has been established that oils and hydraulic fluids in systems and on ARP test stands and units are changed most often because of the presence of various contaminants in them. The use of spectroscopic and X-ray spectral methods of analysis makes it possible not only to evaluate the purity of oil and the need to replace it, but to determine the initial stages of breakdown of lubricated assemblies and parts by the content of metals in the oil. So GSM economy may also be achieved by introducing advanced methods of engine diagnostics and efficient means of removing impurities from the GSM's. The gain from the results of such work, taking into account the high cost of oils (the cost of certain types of aviation oils is as high as hundreds of thousands of rubles per metric ton) and their critical shortage, is obvious.

Substantiating the norms for GSM consumption is another task. It is essential that these norms and measures for their economy not be determined by operating organizations (the consumer) on the basis of statistical data, but by the developer of an aircraft at stages in its development, taking into account structural features and operating conditions. Development of the consumption norms should not be concluded; the developer of the aircraft should adjust the existing norms on the spot based on experience in operating the aircraft (information on initial GSM consumption and changes in operation) and prepare the appropriate changes in the operating documents for specific types of aircraft. In this case, the process of setting norms for GSM consumption in stages of an aircraft's activity cycle will become continuous and controllable.

We know that significant losses of GSM take place as a result of violation of the rules for their storage, transportation, and distribution. First of all, it is essential that leakage and spillage of GSM's, which not only inflict substantial economic harm, but have a detrimental effect on the ecological situation, be prevented. In addition to adhering to established requirements, we need to develop and introduce automatic systems at GSM storage points to monitor volume and warn of leaks for this purpose.

Savings also may be achieved by increasing the length of time that GSM's are stored. Results of a study show that the periods of time that fuels are being stored in aircraft tanks are not the maximum periods, and they can be extended for twice as long or more. One of the reserves here is reducing fuel losses from evaporation by ensuring that technological equipment is consistently in good working order, that "breather" valves (filters) are installed and correctly adjusted, and that plugs are installed in the aircraft's fuel drainage system. Development of technologies to completely remove the remains of GSM's from railroad tank cars and other transportation and storage facilities is advisable as well.

In the process of aircraft operation, it is important to reduce to a minimum the amount of time that aircraft "wait" for takeoffs and landings; that aircraft taxi to the parking area after landing and runout with the minimum number of engines in operation; that aircraft be fueled and maintain flight regimes in strict conformity with planning calculations for the flight; that requirements of the RLE [operating manual] be followed in using the takeoff regime in climb conditions; that exercises be combined; and that aircraft be towed (when possible) after they land and taxi off the runway.

The aircraft developer, together with an NIO [scientific research facility], must study the question of reducing the length of time for engine run-ups and post-maintenance check flights to a minimum by improving the organization and quality of work and by improving the ways and means of monitoring aircraft serviceability. In aircraft maintenance and repair, attention should be increased in monitoring the efficiency of fuel measuring equipment in order to achieve the accuracy required in measuring fuel volume; the aerodynamic configuration of the aircraft should be protected, foreign material must not be permitted to accumulate on lifting surfaces, and dents, abrasions, and other damage to them should be prevented; loose-fitting hatches and doors should be adjusted; all used GSM and fuel residue should be collected, accounted for, and sent to storage facilities; ground facilities should be used extensively for preheating aircraft engines before they are strarted; sources of electricity and air conditioning should be used which do not require engines to be started when aircraft equipment requiring current is checked; assemblies and parts of aircraft should be cleaned during repair with the synthetic detergents authorized for use; and fuels and oils should be reprocessed at all aircraft repair enterprises for repeated use in testing and running in systems.

And finally, in our view, nearly the most effective means of achieving efficiency in measures to economize aviation GSM's is by increasing the economic incentive to do this in all aviation repair enterprises involved in the operation and repair of aircraft and in the provision of these materials.

Military Production Conversion Problems, Prospects Reviewed

93UM0447F Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) pp 11-13

[Article by A. Lazukin, candidate of historical sciences: "Is Conversion a Routine Matter?"]

[Text] **This is not the first time the problem of converting military production has arisen in our country. Back in the period from 1892 to 1902, Tsarist Russia's expenditures for military needs were reduced from 30 to 15 percent of the state budget at the insistence of S. Witte, the minister of finance.**

The first major conversion during the Soviet period was from 1920 to 1924. The second conversion in our country's history came in the five-year period after the end of the Great Patriotic War. The enterprises and sectors which had actually been mobilized returned to the usual peacetime production. The third conversion, from the late 1950's to the beginning of the 1960's, manifested itself in a radical unilateral reduction of the Armed Forces by 2 million persons altogether. This produced tangible results—it made it possible to improve pensions for the public and sharply increase the scale of housing construction. However, the conversion was implemented by command methods, without a well-thought-out plan and consideration of the social consequences.

The current conversion "originates" in 1988. It is attended by major problems. How are they being resolved in the current stage? What is the nature and what are the features of the conversion of military production in the transition to market relationships? Let us try to answer these questions.

The word **"conversion"** comes from the Latin, and means **"change."** In analyzing the scientific literature and periodical press, we discover that a common interpretation of this term does not exist in military economics. In most cases, the authors agree that conversion is linked with the economic realization of the disarmament process in both the production and nonproduction spheres. It implies the reduction of military enterprises and their shift to civilian production, a cutback in armed forces, a decrease in military expenditures, and so forth. However, for a better understanding of the military and economic problems of conversion, it seems expedient to divide it into its three forms: the conversion of military production, conversion of the armed forces, and social conversion.

The conversion of military production consists mainly of a combination of financial, economic, organizational, and technical steps to shift a substantial part of military industry and military scientific research institutions to civilian use. Conversion of the armed forces consists of a combination of steps to cut back the army and military expenditures and dismantle military facilities, equipment, and weapons, and so forth. Social conversion infringes upon the interests of servicemen discharged from military service, as well as the workers and white collar employees that have been cut back.

The need for military economic conversion is determined by objective factors. Militarization of the economy in the former Soviet Union reached a scale that was inconceivable for peacetime. According to some estimates, 80 percent of the scientific potential in the CIS is working in the military industrial complex (VPK), which devours up to one-quarter of the national income and has turned into "an insatiable Moloch." For decades, defense has made use of the best personnel, advanced technologies, and expensive raw material in short supply, while the other sectors have gradually fallen behind technologically, and many of them have been doomed to turn out ineffective and short-lived products. There are military-political prerequisites for implementing the conversion as well. Under current conditions, auspicious circumstances have taken shape following a change in the world situation which contributes to the relaxation of tension, stablization of world peace, and consolidation of the international security system. And this is very important to point out, since conversion makes no sense if implementing it upsets strategic parity and increases the danger that war will be unleashed.

Various points of view on the strategy, tactics, stages, and periods of time for military economic conversion are encountered now: some specialists support its implementation in several lengthy stages, and others want it carried out in a year or two. The latter often refer to experience in the United States, where the postwar conversion was accomplished in 1 year. However, they forget that there was no economic crisis or mass unemployment in America during that period.

I would very much like to believe in the reality of a "quick" conversion, but our problems and specific conditions have to be taken into account. First of all, a regular military industry has existed and still exists here, but in the United States arms production during World War II was carried out basically by enlisting civilian enterprises from the private sector, whose owners knew this was a temporary arrangement. After the war they quickly made the transition to peacetime production. Our economic structure was formed especially for military requirements, and its reorientation to turn out civilian products is considerably more complicated for this reason. For example, not long ago the USSR Ministry of Atomic Energy and Industry—Minsredmash [Ministry of Medium Machine Building] was abolished, but it really continues to function, although not on the previous scale. It includes defense enterprises, nuclear production and nuclear power generation, closed cities, and thousands of "boxes" scatered throughout the country in which about 1.5 million persons are employed.

In addition, an important scientific potential is available: collectives of NII [scientific research institutes] and laboratories, and scientists whose creative abilities are no less a resource, if not a greater one, than our natural resources. It is doubtful that all this can be respecialized at one stroke, in a year or two.

Second, we have a much larger administrative and management apparatus for the military industrial complex than in the United States. It is not prepared to operate successfully in the civilian market yet. Moreover, without certain resistance, such powerful, far-flung military economic organizations do not vanish by themselves. Various conceptions and the practice of self-preservation are developed in the midst of the military industrial complex, and overcoming them in a short period of time is not a realistic task by any means.

Third, it has become necessary to determine the fate of persons released from military production and the collectives of various military scientific organizations being separated from the ranks of the Armed Forces. There is no clear idea at present how many will be unemployed and how the social problems of these people will be resolved.

Fourth, the problems of financing the military economic conversion have not been solved. The enterprises being shifted from military to civilian production obviously do not have sufficient funds, especially because of the orientation toward market relationships and the economic isolation of regions and republics.

Fifth, while conversion in the United States and West European countries means reducing the production of weapons and military equipment under the conditions of a highly developed economy and political and financial stability, the situation is different in Russia. We have to implement the conversion under conditions of social and political instability, hyperinflation, and the production recession. At the same time, we cannot allow our defense potential to decline. The emphasis should be on improving its quality and substantially reducing expenditures of material, financial, and human resources.

Conversion of military production in Russia is also called upon to put the financial situation in order, saturate the market with consumer goods, improve material and technical support for the nonproduction sphere, raise the scientific and technical level of civilian production, and contribute to the renovation of enterprises in the machine building complex, technical equipment of the agroindustrial complex, and the promotion of foreign economic ties.

How these tasks will be carried out depends on many factors, including the directions chosen in the policy and practice of military production conversion. The basic directions have already been determined at this time—shifting military industry to national economic production; utilizing the scientific and technical potential of the defense complex in the interests of the national economy; commercial use of a number of defense enterprises and military technology; shifting the military industrial complex to the development of new types of dual-purpose equipment, technologies, and materials, and so forth.

In the science-intensive sectors of the defense industry and a number of NPO and KB [scientific production associations and design bureaus] dual-purpose products were being turned out even previously—electronic, aircraft, and laser equipment, communications, and computers. However, under conversion conditions, the use of innovations for both defense and the national economy assumes special importance. Unlike in previous years, it is planned to accomplish this now from the first designs, drafts, and specifications. In the specialists' opinion, this approach will make it possible to reduce expenses for NIOKR [research and development] by one-third to one-sixth as much, sharply reduce the times for introducing new achievements, and increase the quality parameters of military equipment.

The shift of part of military industry to **the production of output exclusively for the national economy** will make it possible to resolve a number of critical problems in the economy, such as increasing the output of equipment and agricultural machinery for the agroindustrial complex, new production lines, and installations and automatic equipment for processing sectors. Production of about 1,400 descriptions of new equipment will make it possible to almost completely replace the existing products list in light industry. Production of medical equipment will be increased, mainly because of the acquisition of new products—from disposable syringes to mobile self-contained life support complexes. Development and production of advanced equipment for the trade sector will make it possible in the future to provide for the storage, packaging, and processing of products. The output of household appliances and instruments is being given an important place in the conversion of military production.

The Perm military enterprises "Avrus" and "Elektron" have been partly switched to peacetime production. They are turning out motorized units for gardeners, household electronics, tourist equipment, sections for summer houses, and other commodities needed now.

There is considerable public demand for products from the Plant imeni M.V. Khrunichev—children's "Druzhok" bicycles (220,000 annually), pressure cookers, kitchen furniture, garden houses, sleds, ski-poles, and the like. The proportion of consumer goods and civilian production in overall production volume amounts to 25 percent. The plant is preparing to turn out equipment to shift automobiles to gas power. In order not to lose the high technological potential, two principle directions have been outlined: **medicine**,to turn out "Superterm" units for treatment of tumors with localized heat, and **ecology**, to develop robots to deal with emergencies, taking the Chernobyl experience into account.

All this is basically turning out by-products, or so-called **partial conversion.** The former union government program planned to implement the conversion at 428 defense complex enterprises and more than 100 enterprises in nondefense sectors. But only six defense enterprises and 34 enterprises in civilian sectors were to have been subject to **full conversion**; the volume of military production was to have been reduced from 20 to 30 percent at 180 enterprises, by 20 percent at 118 enterprises, and by 10 percent at 124 enterprises. At the same time, it was proposed that a stream of the most up-to-date commodities—cooking units, washing machines, and refrigerators—be poured into the stores. There have been figures, and there have been plans and programs, but there have been none of the commodities in critically short supply. But why are real results not seen? There are a minimum of four reasons.

First of all, the conversion was proclaimed, but not coordinated with the economy or with social problems. There was no clear conception of how to conduct the conversion of military production and none of the necessary documentation. The financing of a number of enterprises in the military industrial complex which could have turned out such products without special expense was curtailed by willful decision. Enterprises in the military industrial complex have very high overhead expenditures. If they begin turning out consumer goods on a small scale, they will be "like gold." Who needs this? Who will buy them at fabulous prices?

The real point of the conversion of military aviation production is not to fill up the stores with consumer goods, but to turn out civilian products based on advanced technologies. This includes the development of new passenger and cargo aircraft and the development of advanced engines and highly productive machinery and equipment.

Thus it becomes apparent that during the period of reduced expenditures for arms and the transition to market relationships, the preferred strategy is the **complete shift** each year of a certain number of military enterprises to turn out science-intensive and high-tech civilian products. How is this problem being resolved in practice?

Russia plans to discontinue production of the most powerful aircraft in the Air Forces—the supersonic Tu-160 combat jet and the long-range Tu-95MS turboprop bomber. What will the aviation industry enterprises which are turning out these strategic bombers be working on? The aircraft manufacturers in Samara may organize mass production of the medium-range Tu-154M, which is in considerable demand here and abroad. The Kazan Aircraft Plant will provide for additional production of the long-range Il-62M, and then begin series manufacture of the latest Tu-204's. Thanks to this, the high technological and production potential of the enterprises will be completely maintained; this would hardly be possible if they relied upon the production of frying pans, let us say, or even juice squeezers.

Certain opportunities have appeared lately to make use of foreign investments and credits to shift a number of our military enterprises to peacetime production. Agreement was reached at the first meeting of the Russo-German Consultative Council in Bonn in March 1992 to place a foreign currency order for 10 billion German marks. For this money, firms in the FRG are to reequip several Russian military plants to produce consumr goods.

One of the largest American investment firms, (Betterimarg) Financial Management, will invest $500 million in defense sector enterprises being converted, according to preliminary agreements. Some 40 enterrprises in the military industrial complex will take part in the project. They have submitted their proposals to develop the production of civilian output. At present, in the first stage, six enterprises have been selected, including "LOMO"—an optical machinery association in St. Petersburg, where they will be turning out medical endoscopes and microscopes in a joint operation. The Moscow Electric Lamp Plant proposes to develop the production of color picture tubes for televisions and computer monitors with the firm's help. The OKB [Experimental Design Bureau] imeni A.N. Tupolev and the Kiev Aviation Production Association are preparing to organize the production of Tu-334 aircraft jointly with Western investors. The product will be sold in the domestic and foreign markets.

The acquisition of foreign credits and the arrangement of investments entail a number of difficulties: first of all, foreign banks and firms do not have firm guarantees at present that expenses will be recovered and they will make a profit; second, many projects need to be closely checked; and thirdly, cooperation is being impeded by our own sluggishness. Hence a general trend is apparent: foreign capital is not hurrying to Russia today—it is watching closely and waiting until our intense life becomes part of normal "market" relationships.

An important role in the conversion is being given to use of the **scientific and technical potential of the defense complex** in the interests of civilian production. About 400 scientific and technical developments will begin a planned "movement" from "defense" to the national economy in the near future, increasing its efficiency. The aviation and aerospace industry should play an important role here. As an example, over 100 world-level advancements developed for the "Energiya" and "Buran" program will be transferred for civilian use. Engines have already been developed for the Il-96 and Tu-204 passenger aircraft at the Central Aircraft Engine Institute. This will help civilian aircraft manufacturing to come closer to the world level. Scientific research institutes and design bureaus in the defense complex have over half of the major research efforts and advancements under way in the country at present on subjects of importance to the national economy. Some 158 leading scientific research institutes and design bureaus in the defense sectors have been enlisted to develop technological equipment for the processing sectors alone.

(To be concluded)

Theory of More Efficient Propulsion Method Explored

93UM0447G Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) pp 32-33

[Article by Lieutenant Colonel V. Maksimovskiy: "A New 'Perpetual' Engine?"]

[Text] **There are examples in the history of science of revolutionary discoveries by persons working alone which give impetus to a more precise definition of fundamentally new knowledge, the development of directions for application, and the creation of equipment which serves man firsthand. The pace of evolution is gradually declining. But this is where a new fundamental discovery usually follows and the cycle is repeated.**

In our time, man needs to make use of more and more energy. But in doing this, he ruins his own environment. All the well-known methods of surmounting the crisis that has developed are based on traditional approaches, and taking into account the sluggishness of our consciousness, they may turn out to be insufficiently effective or overdue for that reason. But there are persons capable of getting "off the beaten path" and suggesting alternatives which go beyond the limits of established conceptions. The bearers of these ideas are often eminent scientists, and they must have irrefutable arguments to support new theories. The pioneers follow a long and thorny path for this reason. We will acquaint our readers with one of these persons and his ideas.

V. Shabetnik, senior scientific associate of the NPO [Scientific Production Association] of Experimental Machine Building and candidate of technical sciences, suggests that airborne vehicles using a unique means of propulsion be built. Craft such as these will not need hydrocarbon fuels.

Two 'Whales' [scientific progenitors]

Vasiliy Dmitriyevich long ago set himself the task of finding a means of doing without the use of thermal energy in engines by converting the energy from an on-board source directly into performance. The point is that the disorganized thermal movement of molecules in a working fluid cannot be completely regulated by organizing the process of its discharge in rocket or jet engines, and thrust is created in them very inefficiently for this reason. Shabetnik came to the conclusion that Tsiolkovskiy's formula is similar to Boltzmann's formula, which characterizes the entropy of a system and confirms the need for very high expenditures of energy to boost rockets to high speeds. Indeed, the useful load eliminated in low near-earth orbit makes up only 2 to 4 percent of the initial mass of a booster rocket. This conclusion applies to all engines which utilize the energy of discharged masses to create thrust, including plasma, ions, and photons. But if we are referring to manned flights beyond the solar system, when much greater speeds must be reached, there are serious doubts about the possibility of realizing them.

First of all, Shabetnik came to the conclusion that the fundamental subatomic particles (electrons, protons, and neutrons), as well as photons, have a structure that is quite specific. This conflicts with the assumptions of quantum physics and the statistical, random concepts of matter. But it was precisely such an approach that made it possible to evaluate the phenomenon of superconductivity in a completely untraditional way and to arrive at the creation of high-temperature superconducting materials. Their use makes it possible to eliminate the losses of electric energy and to develop fundamentally new devices.

Second, an innovator had established and explained the phenomenon of energy conversion. Back in 1959, our scientist P. Oshchepkov conducted an experiment: he sent current through a semiconductor and measured the heat release. It turned out that 2.19 times more thermal energy is obtained than if electrical energy is used. At the same time, the phenomenon was not explained. Shabetnik determined the conditions under which several times as much energy is obtained through the internal energy of a substance than is conducted to a device. Thus, he considers a fourfold increase in it to be technologically feasible. And this makes it possible to create an energy generator.

'Muhammad's Coffin'

How does Shabetnik visualize the configuration of a spacecraft? In his opinion, a hull spherical in shape is best suited for flights in outer space. It should be covered entirely with a layer of superconductive material (in the jargon of physicists, this is called "Muhammad's coffin"). No less than three accelerators of high-velocity electrons will be positioned inside the hull, closer to the envelope. The accelerators should have the opportunity to move along the "equator" of the spacecraft. One of the atomic reactors which have already operated in space may be used as the on-board source of energy. However, if a generator invented by the author of this suggestion is used, the entire system becomes completely safe and ecologically clean. Only one initial "charge" of electricity will be needed from the generator, which will be developing energy by utilizing the effect of energy conversion mentioned and the continuous currents in the semiconductor. With an excess in the amount of energy obtained which is four times the amount consumed and accelerators with KPD [efficiency] equivalent to 30 percent, this generator should produce 20 percent of the energy "pumped in" initially.

Operation of the System

The high-velocity electrons emitted by the accelerators "fly out" of the spacecraft along the superconducting envelope and induce an electrical current in it which supplies the generator. The movement takes place through the interaction of this induced current and

another current—the flow of those same electrons that were emitted. An ampere force is developed that is proportionate to the product of force from the currents and the area of the semiconductor interacting with the field of electron flow and inversely proportionate to the distance between the currents. This distance is very small, because the electrons are moving along the length of the envelope. So "Muhammad's coffin" flies as if it were repelled by the magnetic field created outside the spacecraft by the high-velocity electrons being emitted. The thrust is perpendicular to the direction of their movement. By controlling this movement and increasing the current, the direction and speed of flight may be controlled.

The inventor is convinced that such a craft does not constitute a closed system together with the electrons. After all, they are "ejected" by the accelerators into the surrounding space, and by creating a magnetic field and inducing current in the superconducting envelope, they do not belong to the spacecraft. That is, in his opinion, this is not a suitable analogy to the story about Munchhausen pulling himself out of a bog by his hair—the laws of physics apply.

The Possibilities

So the acceleration that such a spacecraft can achieve in space depends on the area of the superconductor's surface and the capacity of the on-board accelerators (and of course, the external gravitational force of celestial bodies). If it flies at an acceleration equal to that of the earth, the craft will reach a speed close to the speed of light in less than a year. The craft will continue in free flight into the vicinity of the planetary system or star being studied and then it will decelerate. This is how we may travel through the galaxy, resolving the problem of weightlessness for astronauts at the same time.

Some readers will think this is another fantasy like the "perpetual" engine. This is not surprising—a completely normal reaction. But does the author only have ideas? Of course not! Realizing how difficult it will be to defend his theory and believing it necessary to achieve recognition in scientific circles right away, Vasiliy Dmitriyevich adopted a flexible tactic. He delivered papers at Gagarin and Tsiolkovskiy lectures and certain scientific conferences and filed claims for the invention. By working in a sectorial NPO, he made his work noticed by high scientific officials, and they have not hindered him. Now there are published works, and they are known here and abroad. Now we cannot pretend that there is no theory.

What Has Been Done?

But how is practice a criterion for truth? And practice already exists. Persons were found at the NPO EM [Experimental Machine Building Scientific Production Association], including managers such as V. Pallo (he is the chairman of the enterprise's Astronautics Federation Committee), who considered it expedient to conduct experiments to verify the new principles that had been set forth. These tests were held in March and May this year. The work was put into the official records of the respected organization and a movie was made. The behavior of models of high-temperature superconducting materials of the Y-Ba-Cu-O type was studied when joined to a hull in which electrodes had been arranged. A pulse (about 7 ns) of electrical current (about 150 amperes) was fed to them, bringing about the flow of electrons. The models were placed in tanks with liquid nitrogen, since the effect of superconductivity appears at that temperature. The last test was most significant: a superconductor 1.7 square centimeters in area developed a force of more than 22.5 grams. It was 1.5 millimeters thick and had a mass of 2 grams.

In addition, the high-temperature superconducting material that Shabetnik developed is undergoing an official test.

What conclusions have the researchers drawn? First of all, that the principles set forth by the author are correct. Secondly, in the near future it will be necessary to complete refinement of individual assemblies, conduct a synthesis of new high-temperature superconducting materials, and begin development of an airborne vehicle prototype with a diameter of up to 5 meters and a mass of up to 5 metric tons.

The Outlook

Many other obstacles have not been surmounted yet, of course, but the matter is worth active study. It is necessary to be convinced once and for all of the validity of this means of propulsion. Our country has indisputable priority here. And if the author is correct in obtaining materials with a superconducting effect at temperatures of over 800 degrees C., such means of transportation may be developed for trips at the earth's surface: not only instead of motor vehicles, locomotives, and diesel vessels, but airplanes as well. New booster rockets may make their appearance. There will be advanced, ecologically clean means of transportation. But for the present, the manufacture of spacecraft is the most practicable. Aside from other advantages, if these craft are spherical in shape, they are protected by their field from most meterorites.

It is interesting that models in the experiment moved like "flying saucers." Movements and changes in direction were instantaneous. Who knows, perhaps V. Shabetnik has unraveled their secret (if one exists). But this is not important if such devices make their appearance. We ourselves may become inhabitants of another planet to someone else, and our earth will become cleaner and more suitable for human life. Why hurry to migrate to other planets and space stations? After all, the sun will be shining for everyone even longer!

Development of U.S. Satellite Technology Reviewed

93UM0447H Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) pp 38-39

[Article by V. Glushko: "Satellites Bearing the Stars and Stripes"]

[Text] **Analysis of trends in the development of science and technology in the United States leads to the conclusion that the Americans are placing a great deal of hope in the use of outer space and that they will continue to do so. Space systems are playing a more and more important role in performing various military and civilian tasks now.**

More than 160 artificial satellites owned by firms and departments in the United States are operating in near-earth orbits, and most of them (about 75 percent) are functioning in the interests of the U.S. Armed Forces. At the same time, it is important to note that applied satellite systems developed under the aegis of the U.S. Department of Defense have stimulated the development of similar civilian systems and contributed to their improvement. At present, groupings of military spacecraft with 17 support systems are operating in space. They include space systems for communications and combat control, navigation, reconnaissance, topographical geodesy, and meteorology.

Advanced satellite communications for military purposes provide up to 75 percent of the channels for transmitting information in operational-tactical and strategic echelons. Spacecraft are positioned in a geostationary orbit on the plane of the equator in this case. They make a revolution every 24 hours as if they are "hovering" over a certain point on the earth's surface. This provides the opportunity to serve users in such a way that communication is organized on a global scale when three communications relay satellites, such as the TDRS, are positioned aappropriately.

The (DSTsS) and "Afsatcom" systems function in the strategic command and control echelon of the U.S. Armed Forces. The first one is primarily to provide continuous two-way global communication for the control interests of the U.S. Armed Forces. The main organization that developed it is the TRW firm, one of the most influential in the space sector.

The "Afsatcom" system serves to provide reliable control of the U.S. nuclear forces. Its main distinction is the lack of "its own" satellites. Communication is provided through relays installed on the spacecraft of other systems, such as "Fleetsatcom," "Lisat," (DSTsS-3), "Milstar" (in prospect), and spacecraft of the "Navstar" navigation system.

In the future, development of the "Afsatcom" will be focused primarily on improving its noise suppression and viability. In this regard, high hopes are being placed on use of prospective "Milstar" communications satellites, whose full-scale operation is planned for the mid-1990's. According to statements by American specialists, their use will make it possible to provide all strategic nuclear forces and all forces in theaters of military operations with reliable two-way communications. It will make use of sensors to record contacts with foreign objects and means of defense from attack, including "evasion" of enemy interceptor satellites, and so forth, to counter enemy action. In order to increase the viability of the entire system, provision has been made to put several "dark" satellites in orbits at an altitude of about 200,000 km which can be transferred to geostationary orbits to replace spacecraft, which have failed during the course of combat. Apart from this, the "Milstar" satellites will be included in the communications system in the "Fleetsatcom" operational-tactical echelon, which now provides continuous global communication in the interests of controlling the mobile units of the Navy, the Air Force, and ground forces and includes the "Lisat" and "Fleetsatcom" satellites.

It should not be assumed that the MO [Defense Department's] requirements for space communications are being met in full by the systems enumerated, however. Private firms' satellite channels are being leased extensively by military departments in the United States.

Commercial use of communications satellites began back in the mid-1970's in the United States. It was at that time that a number of private firms began developing and deploying them with their own resources. At present, eight commercial satellite communications systems have been united under the common name "Domsat." The development and operation of communications KA [spacecraft] is the most profitable field of commercial activity in space at present, despite the competition from cable communications systems with fiber optics.

The "Domsat" system includes the "Westar," "Satcom," "Comstar," SBS, ("G-star,") "Spacenet," "Galaxy," and "Amersat" satellites, whose main developers are the Hughes Aircraft and RKA firms. As an example, the ("G-star",) which has the most advanced spacecraft, transmits digital information for government and commercial institutions located in the continental United States, Alaska, and Hawaii, it relays television programs and conducts television conferences. Two spacecraft function continuously. Some of the channels are leased by the U.S. Department of Defense.

At the same time that communications satellites were deployed, the United States began operating systems for conducting reconnaissance from space. They conducted observations (photography) over a route and optical scanning of the surface of continents and the world's oceans located under the satellite's orbit, and they also performed detailed reconnaissance in parts of the planet of particular interest.

Work is now under way to improve existing reconnaissance satellites and develop new ones. Some spacecraft of the last generation make it possible to obtain highly detailed pictures of ground objects, even when reconnaissance is conducted at night or in dense cloud cover.

Imaging reconnaissance satellites are being developed and operated within the "Keyhole" program. They are equipped with electronic optical gear which can obtain images (with relatively low resolution) of extensive areas and is used for regular observation and identification of fixed objects or detailed, high-quality imagery of objects of special interest. In this case, a photograph may be taken from low altitude (up to 130 km).

The first KH-11 satellite was launched in a synchronous solar orbit in 1976. Reconnaissance is conducted when the sun's rays fall on the object being observed at a consistent angle, which makes it possible to measure the shadows from the objects and determine their dimensions and movement. The KH-11 transmitted high-quality, detailed imagery in close to real time. In August 1989, the MTKK [space shuttle] "Columbia" put an improved version of the KH-11 in orbit which can distinguish objects over 15 centimeters in size. The images received from the satellite in the form of digital signals are transmitted to ground stations in Greenland and islands in the Pacific Ocean; from there the information is sent by commercial satellite communications channels to the National Processing Center in Washington, and then to the consumers. Two satellites of a new type—the KH-12—were added recently to the existing space reconnaissance systems. It was precisely with their aid that the first reports of Iraqi troops' movement into Kuwait were obtained. According to (G. Pike), an expert on matters related to the uses of outer space from the Federation of American Scientists, the resolution capability of the reconnaissance spacecraft is not inferior to the space telescope of the HST satellite-observatory. The KH-12 is capable of descending to 160 km and obtaining images of objects measuring more than 7 centimeters.

Nevertheless, the ISZ [artificial earth satellites], which conduct observations in the optical range, do not provide solutions to all the problems. This is because during the late fall, winter, and early spring, territory of the former USSR and the many countries of Eastern Europe is obscured by clouds 70 percent of the time. This was the reason for launching the satellite "Lacrosse" in December 1988 with the help of the space shuttle "Atlantis." The radar equipment installed in it makes it possible to conduct reconnaissance in any weather conditions and to detect objects the size of a passenger car.

A great deal of work is also being performed by electronic reconnaissance satellites: the "Ferret," "Magnum," "Aquacade," "Wide Cloud," and certain others. Inasmuch as military and political organs cannot function without continuous communications, the interception of traffic with the aid of these spacecraft often yields very important information. The signals received are analyzed, and deciphered when necessary. Huge antennas make it possible to intercept dozens of telephone conversations on radio channels simultaneously, to obtain "foreign" telemetry information, and to acquire information needed on electronic and radar facilities.

However, observation of the ground surface is being conducted not only for military purposes. A satellite system for studying natural resources based on the "Landsat" spacecraft provides information for firsthand use in geology, ecology, agriculture, oceanography, and the like. The on-board observation equipment, which operates close to the infrared range, helps in locating minerals and mineral resources. By using such satellites together with high-speed computers on the ground, an inventory of agricultural crops in an entire region can be obtained in a few hours.

Information on the condition of a sea can now be obtained directly from a satellite by microwave radar methods. The "Seasat" satellite maps icefields, records wave height and direction, and a temperature change of 1 degree; it scans the water surface to a depth of up to 20 meters, determining the places where fish have concentrated, the directions of iceberg movement, and so forth.

New "Mapsat" satellites for reconnaissance of natural resources have been put into operation recently. They have more technical capabilities than their predecessors and make it possible to obtain multispectral stereoscopic images. Use of them makes it possible to automate the process of processing information and to create topographic and special maps. One such spacecraft is capable of surveying over 3 million square km per day. The information obtained from "Mapsat" is used by the U.S. Department of Defense.

Considerable attention is also being devoted to satellite navigation systems. They help in providing security for shipping and flights and simplify man's activity in an area unequipped for geodetic measurement. These advantages are especially important when satellite navigation systems are utilized in the interests of the armed forces.

The navigation spacecraft "Transit" and "Nova" of the NNSS space system, which supports navigation for the Navy and the "Navstar-1" and "Navstar-2" satellites (in the experimental operation stage) are now functioning in orbit. They enable airplanes, helicopters, submarines, surface ships, and ground forces to determine their position, speed of movement, and altitude. The accuracy in determining position for civilian users is about 100 meters, but for military users who possess coded access to the system it is just 16 meters. In the not too distant future, any person will be able to determine his coordinates at any time of day and under any conditions with the aid of a device no larger than a pocket receiver.

A system based on the "Geostar" spacecraft has become the world's first commercial navigation system, which combines determination of position and transmission of

messages (with the aid of two-way digital communication) at the same time. They are in a geostationary orbit positioned at points over Europe, Africa, and the Atlantic Ocean and make it possible to determine the location of objects with three coordinates. Users of the system, who have transceivers obtained from the "Geostar" firm, send an encoded signal through the satellite to the central computer of a ground center, which relays an answer with the information required back through the satellite to the inquiring station. In the future, each of these satellites will be able to serve up to 5 million users.

The contribution of spacecraft in performing meteorological tasks has been increasing steadily since the early 1970's. The volume of information now being obtained in the United States with the aid of meteorological satellites makes up about 45 percent of all the information used in observations of changes in weather conditions, and it will increase to 65 to 75 percent in the future.

The data rceived from meteorological satellites is especially useful in two areas. First of all, there are extensive regions of the earth where weather information obtained by other means is received very infrequently and irregularly, and satellite information compensates for these gaps. Secondly, satellite information is being utilized successfully for continuous tracking of hurricanes, typhoons, and tropical storms, thereby making it possible to provide warnings ahead of time for the populations in regions threatened by danger. NOAA satellites are making it possible to forecast the weather for up to two weeks. The spacecraft of this system have devices installed to relay distress signals from aircraft and ships in order to determine their position (in the "Sarsat" system). Stations in the ground network of this system are in more than 125 countries. In addition, there are weather reporting systems in operation based on satellites—the GOES, DMSP, and NROSS, which operate in the interests of the U.S. Department of Defense and others.

The United States has been devoting particular attention lately to the development of lightweight satellites in the "Lightsat" program. Their primary advantages are their small size, their high efficiency, and the low cost of launching.

There are also satellites bearing "the stars and stripes" in near-earth orbits which perform general scientific tasks: radiotelescopes, space observatories, and satellite laboratories. They are operated within the framework of special scientific programs. Specialists in the United States are working continuously to improve the space systems and expand the tasks performed by them. So the conclusion may be drawn that the United States unquestionably is seeking to gain and retain leading positions in space.

Tu-160, U.S. B-1B Features, Performance Compared

93UM0447I Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) pp 42-43

[Report by V. Ilin: "The Strategic Bombers"]

[Text] **The most powerful combat aircraft of our VVS [Air Forces], even though there are very few of them, are the Tu-160 strategic bombers. THe program to produce its counterpart in the United States, the B-1B, was concluded successfully 3 years ago. We are publishing brief descriptions of these two aircraft.**

The Tu-160

Crew: Four

Dimensions: Wingspan 55.7/35.6 meters, sweepback angle 20/65 degrees; length of aircraft 54.1 meters, height 13.1 meters.

Mass: Maximum takeoff mass 275,000 kg, maximum landing mass 155,000 kg, maximum payload 40,000 kg.

Performance characteristics: Maximum speed 2,000 km per hour; service ceiling 15,000 meters; range with mission-specific load at supersonic speed over 2,000 kim (recorded as a world record by the FAI [Federation Aeronautique Internationale]; maximum rate of climb 60 to 70 meters per second; landing speed (with a landing mass of 140,000 to 150,000 kg) 260 to 280 km per hour; takeoff run (with a takeoff mass of 150,000 to 275,000 kg) 900 to 2,200 meters; rollout (with a landing mass of 140,000 to 155,000 kg) 1,200 to 1.600 meters; maximum operational g-load of 2.

Engines: Four NK-32 TRDDF [turbojet bypass engines with afterburners] of 25,000 kilograms-force.

Armament: The two weapons bays can accommodate different mission-specific loads, including strategic KR [cruise missiles], short-range UR [guided missiles], nuclear and conventional bombs, and mines.

Equipment: The Tu-160 is equipped with a combined navigation-and-weapon aiming system, RLS [radar] for detecting targets on the ground and sea at long distances, an optical-electronic bombsight, an automatic terrain-following system, and active and passive REB [electronic warfare] systems, as well as a "hose and cone" airborne refueling system. It is equipped with K-36DM ejection seats. Thr cockpit instruments are the traditional electromechanical type. The aircraft is controlled with the aid of a central control column. The RUD [engine control throttles] are located between the pilots' seats. There is a rest area, a toilet, and a cupboard for warming up food.

Status: Experimental operation in the Air Forces began in 1987. It has been turned out in series by the Kazan Aviation Association.

Features of combat use: The Tu-160 is a multimode strategic bomber designed for actions from subsonic speeds and low altitudes to speeds over Mach 1 at high altitudes. Its basic equipment (short-range guided missiles and strategic cruise missiles) enable it to deliver nuclear strikes to targets with preassigned coordinates. In the future, after the aircraft is equipped with highly accurate weapons with nonnuclear BCh [warheads], it may be used against mobile or tactical targets.

The aircraft may be used as a first stage boost for the "Burlak" cruise missile-launch vehicle [krylataya raketa-nositel], which is capable of carrying payloads with a mass of 300 to 500 kg in polar orbits at an altitude of 500 to 700 km, with a mass of 50 to 150 kg in a circular polar orbit at an altitude of 1,000 km, and with a mass of 120 to 220 kg in an equatorial orbit at the same altitude. It is proposed to suspend the launch vehicle, which has a solid-fuel engine and a delta wing, under the airplane's fuselage.

Additional information: The Tu-160's appearance was preceded by a competition for the best design of a multimode bomber, in which the OKB [Experimental Design Bureau] A. Tupolev (an aircraft design using elements of the Tu-144), the OKB V. Myasishchev (the M-18 design), and the OKB P. Sukhoy (a design based on the T-4 aircraft) took part. The work of the OKB V. Myasishchev was considered to be the most successful, although the OKB A. Tupolev had the best opportunities to carry out such a complex assignment; in the final analysis, the latter was charged with developing an aircraft using elements of the M-18 bomber design.

The B-1B

Crew: Four

Dimensions: Wingspan 41.7/23.8 meters, wing area 181.2 square meters, sweepback angle 15/65.5 degrees; length of aircraft 44.8 meters, height 10.7 meters.

Mass: Maximum permissible takeoff mass 216,360 kg, maximum takeoff mass 205,900 kg, empty mass 87,090 kg, maximum permissible payload on internal hardpoints 34,020 kg.

Performance characteristics: Maximum speed 1,270 km per hour at high altitude and 1,040 km per hour near the ground; service ceiling 15,000 meters; maximum range 10,400 km with combat payload of 10,900 kg and additional fuel tank in third bomb bay at optimum flight profile.

Engines: Four General Electric F101-GE-102 turbojet bypass engines with afterburners of 13,610 kg-force.

Armament: The two forward weapons bays, which have a collapsible bulkhead, can accommodate a mission-specific load with a total mass of up to 16,900 kg, including eight AGM-69 SRAM short-range guided missiles and eight B-83 nuclear bombs. In the future the aircraft may be equipped with conventional bombs, as well as AGM-86B ALCM cruise missiles (eight internally and 14 suspended externally; in this case, maximum range in optimum flight profile will be decreased to 7,200 km). Because of the unsatisfactory aspects of separating the combat payload, the aft bay is used only for an additional fuel tank.

Equipment: The offensive armament complex includes Westinghouse APG-66 surveillance and fire-control radar, which also provides for flight in the terrain-following mode; an inertial navigation system; Doppler navigation radar and ALQ-153 backward-looking surveillance radar; the AN/ALQ-161 electronic warfare complex; and satellite communications equipment. The in-flight refueling system includes a telescopic boom. The aircraft has ACES ejection seats. The cockpit instruments include two monochrome multifunction ELT [cathode-ray tube] displays, as well as conventional electromechanical instruments. The aircraft is controlled by a central control column, and location of the engine control throttles is traditional for large aircraft—between the pilots' seats. The aircraft has a cupboard for heating food and a toilet.

Status: The U.S. Air Force is equipped with the aircraft. Series production was discontinued in 1989. Of the 100 aircraft built, three have been lost during operation.

Features of combat use: The B-1 is the U.S. Air Force's first strategic bomber with intercontinental range designed for penetration deep into territory at low altitudes in terrain-following mode. It is intended to destroy targets with preassigned coordinates using the AGM-69 SRAM guided missiles with nuclear warheads, as well as the B61 and B83 free-falling nuclear bombs. The AGM-86B cruise missiles have been launched experimentally from the B-1B, though line aircraft are not being armed with cruise missiles (additional structural modifications of the aircraft are needed for this, but this is not being planned in the years ahead). In planning combat actions against Iraq in 1991, it was proposed that B-1A aircraft, armed with free-falling conventional bombs, be put into use (tests in dropping non-nuclear bombs had been conducted), though insufficient reliability of the engines and incomplete refinement of the defensive BREO did not make it possible to do this.

Additional information: Work to develop a multimode strategic bomber was conducted in the United States under the AMSA program in 1965. The first flight of the B-1A was in 1974. Four prototypes were built. The program was discontinued in 1981 for political and financial reasons. Development of the B-1B was begun in 1982 (it was considered to be transitional until the appearance of the B-2 bomber). In 1984 it made its first flight. The aircraft was delivered to the Air Force from 1985 to 1988. Elements of "Stealth" technology (an air intake duct shaped like a bent "S," radar with a tilted antenna, and radar-absorbing coatings on the air intake ducts and parts of the airframe structure and cockpit windows) were used on the B-1B for the first time. The minimum effective surface dispersion of the aircraft was

reduced to 3 square meters (it was 10 square meters on the B-1A). By 1991, the aircraft had not reached the level of combat readiness planned, since it does not make use of the bomber's principal defensive equipment—the AN/ALQ-161 electronic warfare system, which proved to be unable to suppress several targets simultaneously, and the poor reliability of the engines.

Index of Journal Articles Published in 1992

93UM0447J Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) pp 48-C3

[Index of AVIATSIYA I KOSMONAVTIKA articles published in 1992; entries, which are listed in source by author under subject heads, are listed here in order of appearance, with number of issue]

[Text]

For High Combat Readiness

Flight Safety

Domestic Aircraft: Aviation Engineer and Logistic Support

Training and Education

Military History Articles

Astronautics

Aviation and Space Information

Advertisement for New 'Yak' Light Aircraft

93UM0447K Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92) p C4

[Advertisement: "The 'Yak' Aviation Corporation Offers the Yak-112, the Yak-55M, and the Yak-58 for Sale"]

[Text]

The Yak-112

This is a four-place aircraft for business flights. carrying passengers and light cargo, and patroling. The use of low-pressure tires and a short takeoff run and landing rollout enable it to be operated from short unpaved runways. The aircraft has a TCM 10-360-ES engine made by the U.S. Teledyne Continental Motors firm and avionics manufactured by the U.S. Bendix-King firm. Installation of domestic equipment is also possible.

Cruising speed 250 km per hour

Range 1,200 km

Altitude up to 4,000 meters

Deliveries to begin in the third quarter of 1993

The Yak-55M

This aircraft is intended for aerobatic use. Its good controllability and high power-to-weight ratio enable it to perform complex maneuvers without losing altitude. It is an all-metal monoplane with an enclosed cockpit and fixed landing gear mounted on titanium springs. The aircraft is equipped with the economical M-14P engine.

Maneuvering speed 360 km per hour, stall speed 105 to 110 km per hour

A turn rate of 6 radians per second

Ground level rate of climb 15.5 meters per second

Delivery within three months after signing of contract

The Yak-58

This is a six-place aircraft for business flights, carrying passengers and light cargo, pilot training, and patroling. The aircraft may be operated from unpaved runways. It has an economical M-14P engine; advanced radio communication, flight control, and navigation equipment; and retractable tricycle landing gear. The placement of the power plant provides excellent visibility from the cockpit and improves comfort for the pilot and passengers.

Cruising speed 285 km per hour

Maximum payload 600 kg

Range up to 1,800 km

Deliveries to begin in the third quarter of 1993

The 'Yak' Aviation Corporation guarantees service for the aircraft after they are sold.

**ADDITIONAL INFORMATION MAY BE OBTAINED AND ORDERS MAY BE PLACED AT THIS ADDRESS:
123315, MOSCOW, LENINGRAD PROSPEKT, D.68.
TELEPHONE (095) 157-17-34 AND
FAX (095) 157-47-26.**

Articles Not Translated

00000000 Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92)

[Text]

Publication Data

93UM0447M Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 12, Dec 92 (signed to press 23 Nov 92)

[Text]

English title: AVIATION AND COSMONAUTICS

Russian title: AVIATSIYA I KOSMONAVTIKA

Editor: V.V. Anuchin

Publishing house: Voyenizdat

Date of Publication: December 1992

Signed to press: 23 Nov 92

NTIS
ATTN PROCESS 103
5285 PORT ROYAL RD
SPRINGFIELD VA

2

22161

BULK RATE
U.S. POSTAGE
PAID
PERMIT NO. 352
MERRIFIELD, VA.

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, military, economic, environmental, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available sources. It should not be inferred that they have been disseminated only in the medium, in the language, or to the area indicated. Items from foreign language sources are translated; those from English-language sources are transcribed. Except for excluding certain diacritics, FBIS renders personal names and place-names in accordance with the romanization systems approved for U.S. Government publications by the U.S. Board of Geographic Names.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by FBIS/JPRS. Processing indicators such as [Text] or [Excerpts] in the first line of each item indicate how the information was processed from the original. Unfamiliar names rendered phonetically are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear from the original source but have been supplied as appropriate to the context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by the source. Passages in boldface or italics are as published.

SUBSCRIPTION/PROCUREMENT INFORMATION

The FBIS DAILY REPORT contains current news and information and is published Monday through Friday in eight volumes: China, East Europe, Central Eurasia, East Asia, Near East & South Asia, Sub-Saharan Africa, Latin America, and West Europe. Supplements to the DAILY REPORTs may also be available periodically and will be distributed to regular DAILY REPORT subscribers. JPRS publications, which include approximately 50 regional, worldwide, and topical reports, generally contain less time-sensitive information and are published periodically.

Current DAILY REPORTs and JPRS publications are listed in *Government Reports Announcements* issued semimonthly by the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 and the *Monthly Catalog of U.S. Government Publications* issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The public may subscribe to either hardcover or microfiche versions of the DAILY REPORTs and JPRS publications through NTIS at the above address or by calling (703) 487-4630. Subscription rates will be provided by NTIS upon request. Subscriptions are available outside the United States from NTIS or appointed foreign dealers. New subscribers should expect a 30-day delay in receipt of the first issue.

U.S. Government offices may obtain subscriptions to the DAILY REPORTs or JPRS publications (hardcover or microfiche) at no charge through their sponsoring organizations. For additional information or assistance, call FBIS, (202) 338-6735,or write to P.O. Box 2604, Washington, D.C. 20013. Department of Defense consumers are required to submit requests through appropriate command validation channels to DIA, RTS-2C, Washington, D.C. 20301. (Telephone: (202) 373-3771, Autovon: 243-3771.)

Back issues or single copies of the DAILY REPORTs and JPRS publications are not available. Both the DAILY REPORTs and the JPRS publications are on file for public reference at the Library of Congress and at many Federal Depository Libraries. Reference copies may also be seen at many public and university libraries throughout the United States.